IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	Kiran B. Patel
Applicant	:	Melvin J. Guiles
Art Unit	:	3612
Serial No.	:	10/402,462
Filing Date	:	March 28, 2003
For	:	LOW PROFILE HIGH-STRENGTH VEHICLE DOORBEAM
Docket No.	:	07198.85607-001

Mail Stop AF
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF SAI GADAM UNDER 37 CFR 1.132

1. I, Sai Gadam, am an employee of Shape Corp. (SHAPE) of Grand Haven, Michigan, the Assignee of the above identified application.

2. I have been an employee of SHAPE for two (2) years, and am currently employed as Computer Aided Engineering (CAE) Manager. As such, I am familiar with vehicle doorbeams.

3. As an employee of SHAPE, I work daily with the testing and modeling of components, such as the strength testing of vehicle doorbeams. This testing includes testing with the aid of finite element analysis software.

4. I am familiar with the low profile high-strength vehicle doorbeam constructions that are disclosed in the present application, including the construction shown in Fig. 2 having a first weld line at the lateral edges 26, 28 of the beam and a second weld line at line 32 of the beam (SHAPE DOUBLE-WELD DOORBEAM), and also including the construction shown in Fig. 2 having only the first weld line (SHAPE SINGLE-WELD DOORBEAM).

5. I have reviewed U.S. Patents 6,591,577 to Goto (GOTO); 5,934,544 to Lee (LEE); and 5,813,718 to Masuda (MASUDA); and I understand the construction of the doorbeam disclosed in GOTO (GOTO DOORBEAM), the beam disclosed in LEE (LEE BEAM), and the beam disclosed in MASUDA (MASUDA DOORBEAM).

6. Using techniques that are well known to those in the art, I used finite element analysis to model and compare the respective strengths and load-bearing capabilities of the SHAPE DOUBLE-WELD DOORBEAM, the SHAPE SINGLE-WELD DOORBEAM, the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM.

7. The finite element analysis was performed using LS-DYNA software, a well known finite element analysis software.

8. The geometries of the SHAPE DOUBLE-WELD DOORBEAM, the SHAPE SINGLE-WELD DOORBEAM, the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM were modeled using conventional computer aided design software. Illustrations of the SHAPE DOUBLE-WELD DOORBEAM model and the SHAPE SINGLE-WELD DOORBEAM model are shown in the attached Appendix A, titled "SHAPE DOOR BEAM." An illustration of the GOTO DOORBEAM is shown in Appendix B, titled "GOTO DOOR BEAM." An illustration of the LEE BEAM is shown in Appendix C, titled "LEE DOOR BEAM." An illustration of the MASUDA DOORBEAM is shown in Appendix D, titled "MASUDA DOOR BEAM." The geometry data was compiled from the above identified patent application; the GOTO patent; the LEE patent; and the Masuda patent. Models of each geometry were created based on the finite element sizes that were believed to produce the most accurate results. For

instance, in some cases portions of the beams are modeled and shown as discrete elements instead of smooth, rounded surfaces because the use of smaller elements would produce inaccurate results.

9. The models were then entered into the finite element analysis software, along with material data for each doorbeam. The Shape doorbeam has different material properties in the central portion of the beam, the transitional portions of the beam, and the attachment portions, because the Shape doorbeam is formed by roll-forming the web and then heat treating the ends to form the attachment portions. In order to focus the analysis on the respective constructions of each respective beam, the LEE BEAM, the GOTO DOORBEAM, and the MASUDA DOORBEAM were modeled with the same material properties. Therefore, the modeled material data was the same for the SHAPE DOUBLE-WELD DOORBEAM, the SHAPE SINGLE-WELD DOORBEAM, the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM. The material data is as follows:

Central Beam Portion (illustrated in red): Martensite M220 Steel
(Tensile Strength: 220,000 psi)

Transitional portions (illustrated in blue): Martensite M120 Steel
(Tensile Strength: 120,000 psi)

Attachment Portions (illustrated in yellow): Martensite M80 Steel
(Tensile Strength: 80,000 psi)

The doorbeams were each modeled with the same material thickness (1.76mm). The cross-sectional illustrations shown in the Appendices do not show actual material thicknesses. The lines in the illustrations show the center line of the materials. This is the reason for certain

apparent “gaps” in the illustrations (e.g. between the flanges and the base portion of the LEE doorbeam). These gaps do not exist in the actual models.

10. After the data was entered, I ran the finite element analysis software in order to provide a model of the load that each doorbeam could absorb when deflected. The finite element analysis was intended to approximate the performance of the SHAPE DOUBLE-WELD DOORBEAM, the SHAPE SINGLE-WELD DOORBEAM, the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM under real-life forces, such as those experienced in an automobile accident. Specifically, the finite element analysis was used to approximate the amount of load required to deflect the center of each doorbeam. The analysis calculated the load absorbed by the center of each doorbeam when the ends of the respective doorbeams were attached to springs, and the center of the doorbeam was deflected in increasing amounts. The loads were applied perpendicularly to the center of each doorbeam to simulate a vehicle side impact.

11. The results of the finite element analysis clearly indicate that both the SHAPE DOUBLE-WELD DOORBEAM and the SHAPE SINGLE-WELD DOORBEAM are capable of absorbing higher loads than the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM. In other words, greater loads are required to deflect the Shape doorbeams than the Lee, Goto, or Masuda doorbeams. This is evidenced by the plots of Load (kN) versus Displacement (mm) for each of the doorbeams. Appendix E shows the Load versus Displacement for the Shape doorbeams and the Goto doorbeam. Appendix F shows the Load versus Displacement for the Shape doorbeams and the Lee beam. Appendix G shows the Load

versus displacement for the Shape doorbeams and the Masuda doorbeam. Appendix H shows a plot of load versus displacement for all of the modeled beams. The modeled SHAPE DOUBLE-WELD DOORBEAM, shown in green in Appendices E-G, and the modeled SHAPE SINGLE-WELD DOORBEAM, shown in pink in Appendices E-G, both absorbed approximately a 17 kN load when deflected 170 mm. The modeled GOTO DOORBEAM, shown in dotted green in Appendix E, absorbed approximately a 13.2 kN load, the modeled LEE BEAM, shown in dotted blue in Appendix H, absorbed approximately a 15 kN, and the modeled MASUDA DOORBEAM, shown in orange in Appendix G, absorbed approximately a 14.2 kN load when deflected the same amounts.

12. When the doorbeams have the same thickness as described in the preceding paragraphs, the respective weights of the doorbeams vary. Specifically, when each beam has a thickness of 1.76 mm, the weight of both the SHAPE DOUBLE-WELD and SHAPE SINGLE-WELD doorbeams is 3.252 kgs, the weight of the GOTO DOORBEAM is 3.515 kgs, the weight of the LEE BEAM is 4.109 kgs, and the weight of the MASUDA DOORBEAM is 3.170 kgs.

13. Weight is a critical consideration in the design of vehicle components such as doorbeams. Therefore, a heavier doorbeam is less competitive than a lighter doorbeam having the desired performance characteristics. I therefore also modeled the GOTO DOORBEAM, the LEE BEAM, and the MASUDA DOORBEAM at material thicknesses that would result in beams having the same weight as the modeled SHAPE DOORBEAMS. The thickness of the alternative GOTO DOORBEAM at 3.252 kgs is 1.6 mm, the thickness of the alternative LEE

BEAM at 3.252 kg is 1.4 mm, the thickness of the alternative MASUDA DOORBEAM at 3.252 kg is 1.86mm. The alternate GOTO DOORBEAM, shown in blue in Appendix E, absorbed approximately a 12.9 kN load when deflected 170 mm, the alternate LEE BEAM, shown in red in Appendix F, absorbed approximately a 13.1 kN load when deflected 170 mm, and the alternate MASUDA DOORBEAM, shown in dotted blue in Appendix G, absorbed approximately a 14.8 kN load when deflected 170 mm.

14. The plots of Appendices F and H further show a second alternative for the LEE BEAM, wherein weld lines are hypothetically added between the flanges and the base of the doorbeam as illustrated in the lower right corner of Appendix C. This second alternate LEE BEAM, shown in dotted blue in both plots, absorbed approximately a 15.1 kN load when deflected 170 mm.

15. The designs modeled as described in the preceding two paragraphs show that 1) at the same material thickness, the Shape beams provide superior performance, 2) that at the same beam weight, the Shape beams provide superior performance and 3) even with hypothetical weld lines added to Lee, the Shape doorbeam provides superior performance.

16. The plots shown in Appendices E-H each have a wave-like pattern. This is due to the sampling rate of the finite element analysis. Greater sampling rates can be used in order to reduce the wave-like pattern, however, this would not have a significant effect on the maximum loads seen in the plots.

17. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further

that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SAI GADAM

G. Saiuday kumar 5/24/05

Date 5/24/05

1063934